Beans' defenses mean bacteria get evolutionary helping hand

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Bean plants' natural defences against bacterial infections could be unwittingly driving the evolution of more highly pathogenic bacteria, according to new research published today in *Current Biology*.

The study sheds new light on how bacterial pathogens evolve and adapt to stresses from host plants. This information could help researchers develop new ways of tackling pathogens that cause extensive and costly damage to beans and other food crops.

The scientists from Imperial College London and the University of the West of England (UWE) focused on a bacterial pathogen called *Pseudamonas syringae*, which causes a disease called halo blight, in bean plants. Symptoms include brown spots on the leaves, surrounded by a yellow halo. The disease can cause bean plants to lose their leaves, wilt and die, and is a serious problem for farmers worldwide.

The research team observed that a French bean plant's defensive moves against infection caused *P. syringae* bacterial cells to 'swap' bits of DNA with each other. When one bacterial cell takes up DNA released by another like this, it is known as genetic transformation. This process, occurring within infected plant tissue, could speed up the evolution of more virulent forms of disease-causing microbes say the researchers.

Professor John Mansfield from Imperial College London's Department of Life Sciences, one of the authors of the new paper, explains: "In the course of fighting off infection, and putting the invading bacteria under stress, it seems that the plants inadvertently do them a big favour. By causing the bacteria to throw out selected fragments of their DNA, which can then be taken up by other bacteria cells, the plants are effectively stimulating the bacteria to evolve. For disease-causing bacteria, this means that mechanisms meant to disable them could actually contribute to their continued survival."

When a French bean plant is infected by *P. syringae* it defends itself by sending a suicide signal to the plant cells surrounding the bacteria. When the affected plant cells die they release antimicrobial compounds that are toxic to the microbes. The toxic environment places the bacterial cells under enormous stress.

The new study shows that along with restricting bacterial multiplication, the release of these toxins seems to stimulate *P. syringae* cells to cut out small sections of their own DNA containing genes linked to pathogenicity. These gene 'islands' are then thrown out of the bacterial cell, and absorbed and incorporated into the DNA of other bacteria within the plant.

Professor Mansfield and colleagues are not yet sure exactly how the suicide of nearby plant cells brings about this DNA separation and removal, but say their results could have a much wider implication for how scientists understand the relationship between pathogen, host and pathogen evolution.

Dr Dawn Arnold, co author of the study from UWE's School of Life Sciences, concluded: "Although this work involves plant-bacteria interactions it also has a wider significance in that it could lead to a greater understanding of how bacteria evade the immune system of different hosts including humans."

Source: Imperial College London (news : web)

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